

Preliminary Engineering Report

NuTech Orchard Removal, LLC

vs.

DuraTech Industries International, Inc.

Case No.: 3:18-cv-00256-DLH-ARS
United States District Court
District of North Dakota
Eastern Division

Prepared by:
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February 12, 2020
8553

EXHIBIT 1

3:18-CV-256

ASSIGNMENT

Forensic Engineering Technologies was retained on January 23, 2020 by Attorney Justin Eichmann of Houghton Bradford Whitted PC, LLO to evaluate the design and performance of a DuraTech 5064T horizontal grinder. Mr. Eichmann represents the defendant Duratech Industries International, Incorporated.

In August 2017, NuTech purchased a 5064T Horizontal Grinder from DuraTech to grind almond trees. Machine components include a diesel engine, electronic engine controls, feed floor, PLC, rotor and hammer assemblies, feed wheel, and belly and discharge conveyor assemblies. NuTech removed the discharge-conveyor assembly and attached spreaders to the discharge chute. NuTech operated the 5064T grinder for approximately 1,760 hours. The 5064T horizontal grinder grinds wood waste, green waste, construction and demolition debris, and tree branches and trunks. The machine operated for approximately 800 hours before the rotor bearings were first replaced. Subsequent rotor-bearing replacements became more frequent. Structural cracks at welded connections developed and vibrational issues were not satisfactorily resolved.

My current evaluation of the 5064T horizontal grinder is based upon the material (listed in the section entitled Investigation) provided to me by Mr. Eichmann. My preliminary opinions are based upon the information currently available at the time of this assignment and are contingent upon my inspection of the subject grinder that's being scheduled at a future date. I assume that any information given to me by interested parties is correct and complete.

INVESTIGATION

During our analysis, we reviewed, analyzed, and considered the following items and material:

Pleadings

1. Plaintiff's Complaint and Demand for Trial by Jury filed December 6, 2018
2. Defendant's Answer, Affirmative Defenses and Jury Demand filed February 6, 2019

Discovery Reponses

1. Plaintiff's Initial Disclosures dated March 29, 2019 and documents Bates-stamped Nutech 0001-44
2. Defendant's Initial Disclosures dated March 29, 2019 and documents Bates-stamped DTI00001-39
3. Defendant's Answers to Interrogatories & Responses to Requests for Production dated May 24, 2019 and documents Bates-stamped DTI00040-414
4. Plaintiff's Answers to Interrogatories & Responses to Requests for Production dated May 30, 2019 and documents Bates-stamped Nutech 0045-160
5. Defendant's Supplemental Response to Request for Production dated June 20, 2019 and documents Bates-stamped DTI00415-605
6. Defendant's Second Supplemental Response to Request for Production dated August 9, 2019 and documents Bates-stamped DTI00606-1618
7. Defendant's Answers to Interrogatories (Second Set) dated September 30, 2019 and documents Bates-stamped DTI01619-1622
8. Plaintiff's Answers to Interrogatories & Responses to Requests for Production (Second Set) dated October 4, 2019 and documents Bates-stamped Nutech 0161-244
9. Documents Bates-stamped DTI01623-1639 produced November 6, 2019
10. Plaintiff's Supplemental Responses to Requests for Production dated November 19, 2019 and documents Bates-stamped Nutech 0118-128 (unredacted) and Nutech 0245-257

Subpoena Responses

1. Subpoena Response of Charles A. Hayes d/b/a CH Balancing dated August 1, 2019
2. Subpoena Response of Holt of California dated August 8, 2019
3. Subpoena Response of Quinn Company d/b/a Quinn Power Systems dated October 14, 2019
4. Subpoena Response of Red Barn Equipment Sales, Inc. dated October 22, 2019

Depositions

1. Deposition of Bob Strahm dated August 26, 2019
2. Deposition of Mike Bartle dated August 26, 2019
3. Deposition of Jay Grotrian dated August 27, 2019
4. Deposition of Tim Wehling dated August 27, 2019
5. Deposition of Dexter Long dated October 28, 2019
6. Deposition of Richard Miller dated October 28, 2019
7. Deposition of Omar Huerta dated October 29, 2019
8. Deposition of Eric Hueval dated October 29, 2019
9. Deposition of Javier Garcia dated October 29, 2019
10. Deposition of Catarino Cortex dated October 29, 2019
11. Deposition of Dan DeJong dated October 29, 2019
12. Deposition of Nathan DeJong dated October 30, 2019
13. Deposition of John Vanderhelm dated October 30, 2019
14. Deposition of David H. Long dated October 30, 2019

Plaintiff's Expert Witness Disclosure

1. Plaintiff's Expert Witness Disclosure dated December 2, 2019 and Exhibits A, B and C thereto

PRELIMINARY OBSERVATIONS

Review and analysis of the current materials reveal the following facts about the 5064T horizontal grinder:

1. The 5064T grinder was placed into service with NuTech on October 9, 2017.
2. The service life of the 5064T horizontal grinder was not anticipated to be a consumable product. Except for wear-out components such as hydraulic and engine oil, hammer tips, screens, or filters, the grinder doesn't have a definitive wear-out life. With proper operation, care, and maintenance, the endurance of the 5064T can exceed 1,760 operational hours.

3. Based upon work done by Weibull and means and methods used in reliability engineering, approximately 90 percent of machine failures do not reach a wear-out failure condition. The probability that the wear-out failure of the 5064T signifies equipment misuse involving human error and/or lack of maintenance is high.
4. The cause of vibration is currently unknown.
5. Duratech's design process relies on their experience and collective knowledge. Design is an aggregate effort where products are produced using feedback from sales personnel and the cumulative experience gained from building prior machine models.
6. The rotor bearings in the 5064T grinder are manufactured by Dodge and have designated part numbers P4B526-ISAF-407L (pulley side) and P4B526-ISAF-407LE (non-pulley side). The original bearings and subsequent replacement bearings matched specifications and were installed in their proper locations.
7. The type of seal used in the bearings is a labyrinth design. These seals feature rigid shields mounted to the inner and outer (rotating and fixed) components of the bearing assembly. There are two small gaps: between the fixed shield and rotating inner ring of the bearing, and between the fixed and rotating shields. The gaps form a pathway from the bearing's exterior to interior surfaces. Grease filling the labyrinth lubricates the roller bearing and forestalls entry of external contaminants. As new grease is pumped into the bearing during regular service intervals, the new grease expels gritty unclean grease along with external contaminants from the labyrinth to keep the bearing lubricated and uncontaminated.
8. The originally installed bearings faultlessly operated for over 800 hours. The first bearing replacement, on the pulley side of the grinder, was performed with approximately 815 hours on the grinder. The second original equipment bearing, on the non-pulley-side of the grinder, was replaced on January 26, 2018 with 849 hours on the grinder.
9. Thereafter, replacement bearings began failing at much shorter intervals: 235, 269, and 334 hours respectively for the non-pulley-side bearing (Figure 1). The life of a bearing averaged approximately 280 hours or about one-third the life of the original

part. The pulley-side bearing was replaced at or near the same time that the non-pulley side bearing was replaced.

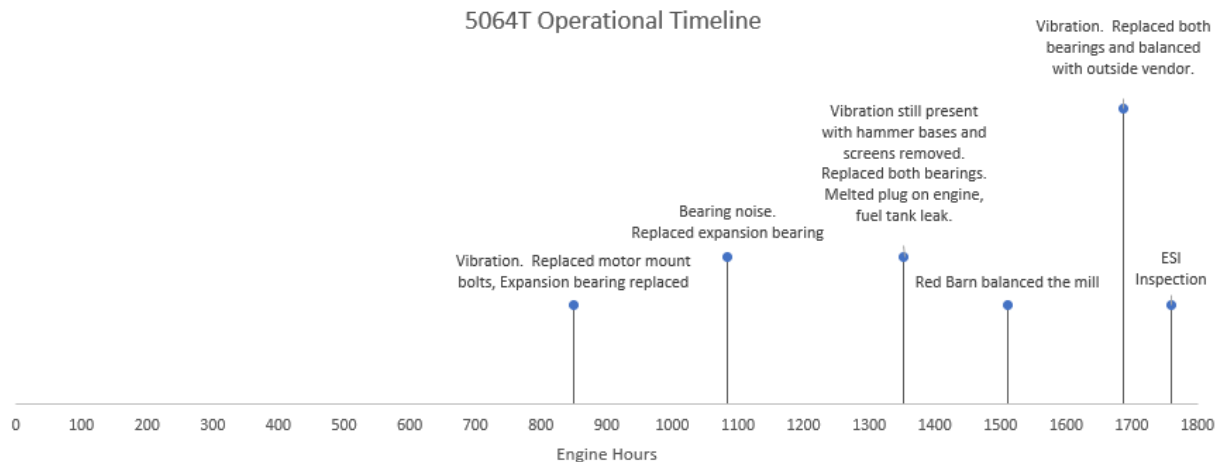


Figure 1: Timeline showing operational repairs verses engine hours.

10. The bearing manufacturer analyzed the original bearings and the first replacement set of bearings. Their analysis showed that the original bearings were insufficiently lubricated and that the lubricant in the first set of replacement bearings was contaminated ("gritty"). Additionally, based on the condition of bearing components, the manufacturer noted insufficient lubrication, dynamic misalignment, and excessive vibration as probable factors contributing to bearing failure for all four bearings.
11. Reports of excessive vibration began with the first expansion-bearing replacement at 849 hours. The hammermill was rebalanced at 1510 hours by Red Barn and rebalanced again at 1687 hours by CH Balancing. Vibrational complaints were reported during each bearing-replacement service. Vibrations continued through service by CH Balancing at 1687 hours and persisted thereafter. The 5064T was transported to Red Barn 70 operational hours later with 1759 hours showing on the machine.
12. No party can confirm that proper rotor-balancing means and methods were used. No party has knowledge that the 5064T grinder was idle long enough to disassemble the hammer mill.

13. Given the frequency of the bearing replacement compared to the service life of the original, under-lubricated parts, the onset of the vibration likely happened sometime between 600 and 800 hours of operation.
14. Software continuously monitors the rotational speed of the hammermill/rotor (rotor speed). Grinding efficiency and throughput relies on maintaining a somewhat constant rotor speed. When the rotor speed falls below a setpoint, the direction of the feed floor and roller reverses then stops in order to remove the load on the rotor and allow it to regain the desired rotor speed. Once the rotor speed is satisfactory, the feed floor and roller restart and grinding resumes. Videos show occurrences when the operator of the excavator pushed trees toward the rotor. Pushing material into the machine potentially allows material to interact with an under-speed rotor when the machine would otherwise be unloading the mill. The effects of such a condition on the rotor or grinder are unknown.

CONCLUSIONS

Based upon review of the material referenced, information available to or obtained by me, and my experience and training as a licensed engineer, I have reached the following conclusions and opinions regarding the condition of the 5064T horizontal grinder:

1. DuraTech correctly specified the rotor bearings, and the installed bearings satisfied their original specifications.
2. Contaminated grease within the bearing indicates that the bearing maintenance was insufficient in terms of grease volume and/or frequency.
3. Sometime prior to the first bearing replacements around 800 hours, imbalance and vibration in the hammermill occurred and continued thereafter. The probability that the hammermill was somehow damaged prior to or near 800 hours is high.
4. After multiple attempts to balance the rotor, the cause of vibration remains unresolved. Other parties report that the 5064T grinder currently vibrates when the rotor is unencumbered and freely rotating.

5. Cracks in the framework and multiple bearing failures are symptomatic of unresolved vibrational problems.

SIGNATURE

The opinions and conclusions expressed in this report are based upon a review of the material currently available to me, as well as my education, training, and experience as a licensed professional engineer, and have been reached within a reasonable degree of engineering probability. These opinions and conclusions are based upon the information currently available to me and may be amended or supplemented should new information become available.



FORENSIC ENGINEERING TECHNOLOGIES, LLC.
John A. Thomazin, P.E.
Project Manager

Appendix A – Curriculum Vitae

Appendix B – Compensation